

**REMARKS/ARGUMENTS**

The present application contains Claims 1 through 54. Claims 4-6, 8-12, 16-18, 23, 24, 28-30, 32-36, 40-42, 47 and 48 have been withdrawn from consideration as being directed to a non-elected specie. Claims 1-3, 7, 13-15, 19-22, 25-27, 31, 37-39, 43-46, 49 and 50 have been examined on the merits. Claims 1, 7, 14, 21, 25, 31, 38, 45, 49 and 50 have been amended. The specification has been amended to cure certain minor informalities. Now new matter has been added

It is noted that the present action is a non-final and is responsive to the communication filed with the Patent Office on August 2, 2005.

It is noted that the drawings filed September 9, 2003 have been accepted and it is further noted that the claim for foreign priority has been acknowledged and that all other certified copies of the priority documents have been received.

Claims 7, 14, 21, 31, 38 and 45 have been objected to. These claims have been amended and submitted that this objection should be withdrawn. Regarding claim 7 and 31 NA has been changed to "numerical aperture", NA being the standard abbreviation therefor. Note, for example, Websters Third International Dictionary, a copy of the Copyright Notice page, and page 1550 and a copy of the definition from Wikipedia accompanying this amendment.

Claims 1-3, 7, 13-15, 19, 21, 22, 25-27, 31, 37-39, 43, 46, 49 and 50 have been rejected under 35 U.S.C. § 102(b) as anticipated by Tiao et al. (Patent '669). This rejection is respectfully traversed.

The examiner makes reference to figure 7A and 8A of Patent '669.

Making reference to figure 7A of Patent '669, the incident surface and the outgoing surface are both curved. Note especially figure 7B showing one integrator 722 in detail. Light emitted from LED 712 is refracted at the curved convex incident surface converges away from the long sides and toward the central axis and is emitted from the outgoing curved convex surface without being reflected on the side surface of integrator 720. Note especially the light rays in two of the integrators in figure 7A and in the integrator 722 in figure 7B. It should be noted that there is no internal reflection along the side surfaces of the integrators 720.

In contrast, the "columnar light leading member" recited in claim 1 of the present application and shown, for example, in any one of the elected species of figures 9A through 11 are configured to guide light to the outgoing radiation end surface by reflecting at least a part of the light rays collected from the incident end surface, on the reflection surface. Thus, the structure, effect and advantages of the present invention are all different from those of figure 7A of Patent '669.

Figures 8A and 8B show "wedge glass rod array 820" which admittedly correspond to the "columnar light leading member" set forth in claim 1 of the present

application. However, in patent "669 the outgoing radiation end surface of the "wedged glass road array 820" and the surface of the "light valve 850" have a conjugate relationship. The structure of figure 8A is typically known as a "critical illumination" type structure.

More particularly, the invention of the present application has an arrangement in which the outgoing radiation end surface of the "columnar light leading member" and the surface of the "irradiation area" (i.e. light modulation element 12) **do not** have a conjugate relationship. For example, noting figure 5 of the present application it can be seen that the distance from the outgoing radiation end surface of the "columnar light leading member" to the "illumination lens 11" and the distance from the "illumination lens" to the "light modulation element 12" are substantially equal to a focal distance  $f$  and do not have a conjugate relationship. The arrangement of figure 8A utilizes a lens array 830 made of individual lens 832 and a converging lens 840. It is clear from the arrangement of figure 8A that the distance between the output irradiation surface of the tapered members 822 and lens 840 and a distance between lens 840 and the light valve 850 is not equal and is not a focal distance  $f$ .

Claim 1 as amended recites the afore-mentioned relationship. Claims 2, 3, 7, 13, 15, 19, 21 and 22 all depend from claim 1 and carry all of its limitations and patentably distinguish over Patent "669.

New claim 51 depends on claim 1 and recites that said distance is a focal length distance  $f$ . New claim 52 recites that the incident end surface and the outgoing radiation end surface are planar surfaces. Note especially the elected embodiments of figure 11 of the present application.

Claim 25 has been amended to recite limitations substantially similar to the limitations in claim 1, as amended. Claims 26, 27, 31, 37-39, 43 and 46 all depend from claim 25 and patentably distinguish over Patent "669.

Claims 49 and 50 have been amended to recite limitations similar to claims 1 and 25 and it is submitted that these claims patentably distinguish over Patent "669.

Claims 1, 13-15, 19-22, 25, 37-39, 43-46, 49 and 50 have been rejected under 35 U.S.C. §102(b) as anticipated by Parker (Patent '216). This rejection is respectfully traversed.

Parker is limited to teaching light pipes 38 provided between light sources 32 and optical integrator 40, and an optical path lens 42. Patent '216 fails to teach an angle position converting member configured to convert an outgoing light angle intensity of the outgoing light from the outgoing radiation end surface of the columnar light leading member into a position intensity in a predetermined irradiation area. Claims 13-15 and 19-22 all depend from claim 1 and it is submitted that all of these claims patentably distinguish over Patent '216.

**Applicant:** Kanunari Hanano  
**Application No.:** 10/657,978

Claim 25, as amended recites the angle position converting member substantially as recited in claim 1. Claims 37-39 and 43-46 depend from claim 25 and it is submitted that all of these claims patentably distinguish over Patent '216.

Claims 49 and 50 likewise recite angle position converting means substantially as recited in claims 1 and 25 and it is submitted that all of these claims patentably distinguish over Patent '216.

In view of the foregoing, it is submitted that claims 1-3, 7, 13-15, 19-22, 25-27, 31, 37-39, 43-46, 49 and 50 are now allowable and reconsideration and allowance of these claims are respectfully solicited and that new claims 51-52, which depend from claim 1, and claims 53-54, which depend from claim 25, are allowable and consideration and allowance of these are likewise respectfully solicited.

The Examiner is invited to contact the undersigned on behalf of the applicant to resolve any issues which may require further resolution with a view to expediting the prosecution.


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In view of the foregoing amendments and remarks, Applicants respectfully submit that the present application, including claims 1-3, 7, 13-15, 19-22, 25-27, 31, 37-39, 43-46 and 49-54, is in condition for allowance and a notice to that effect is respectfully requested.

Favorable action is awaited.

Respectfully submitted,

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Enclosures

# Numerical aperture

From Wikipedia, the free encyclopedia.

In optics, the **numerical aperture (NA)** of an optical system is a dimensionless number that characterizes the range of angles over which the system can accept or emit light. The exact definition of the term varies slightly between different areas of optics.

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## General optics

In most areas of optics, and especially in microscopy, the numerical aperture of an optical system such as an objective lens is defined by

$$\text{NA} = n \sin \theta$$

where  $n$  is the index of refraction of the medium in which the lens is working (1.0 for air, 1.33 for pure water, and up to 1.56 for oils), and  $\theta$  is the half-angle of the maximum cone of light that can enter or exit the lens. In general, this is the angle of the real marginal ray in the system. The angular aperture of the lens is twice this value. The NA is generally measured with respect to a particular object or image point and will vary as that point is moved.

In microscopy, NA is important because it indicates the resolving power of a lens. The size of the finest detail that can be resolved is proportional to  $\lambda/\text{NA}$ , where  $\lambda$  is the wavelength of the light. A lens with a larger numerical aperture will be able to visualize finer details than a lens with a smaller numerical aperture. Lenses with larger numerical apertures also collect more light and will generally provide a brighter image.

Numerical aperture is a measure of the diameter of the aperture compared to the focal length. In photography, this relationship is usually expressed via the f-number,  $f/\#$ , which for a thin lens imaging an object at infinity is given by

$$f/\# = \frac{1}{2 \text{NA}}.$$

## Laser physics

In laser physics, the numerical aperture is defined slightly differently. Laser beams spread out as they propagate, but slowly. Far away from the narrowest part of the beam, the spread is roughly linear with distance—the laser beam forms a cone of light in the "far field". The same relation gives the NA,

$$\text{NA} = n \sin \theta.$$

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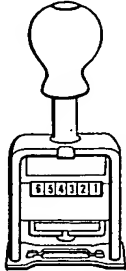
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(Massinger) C APPOINTMENT, DIVIDE (days of this life's pilgrimage ... to ~ wisely —J.W.Warter) (my ... fellows f~ed into two companies —William Morris) 6 archaic : to experience the passage of (an interval of) time (I since then have ~ed o'er some three thirty years —Alfred Tennyson); ex: to reach or have reached a certain position or state (as able body as he ~ed thirty —Shak.) 7 : to comprise in number : TOTAL (they were a miscellaneous lot ... ~ing in all some 20 or 30 —R.W.Southern) (his extensive collection ... ~ing many thousand specimens —Witmer Stone) ~ vt 1 : to reach a total : COUNT (controls ... literally ~ in the thousands —Harold Krentz & Cyril O'Donnell) 2 : to carry off (in sequence) (*kentz, socat*, etc.) 3 : to carry off in Siamese —Kathryn (children) 4 : to call off one's number as a member of a squad or group (men fall in in single rank and ~ from the right in fours —Fire Service Drill Bk.) — often used with off (~lined up and ~ed off) SYN see COUNT  
number \ˈnʌm(b)(r)\ comparative of NUMB  
num-ber-able \ˈnʌmb(ə)rəbl\ adj : capable of being numbered  
number agreement n : grammatical concord in form (as singular, dual, or plural) of adjective with noun, finite verb with subject, or pronoun with antecedent  
number-board \-ˈboɪrd\ n : PLATE 3b  
number eight iron n : SLITCHING NIBLICK  
num-ber-er \-bə(r)\ n-s : one that numbers  
number field \-fild\ n-number system n : the aggregate of all numbers of a given base, as the decimal or rational complex numbers, (vectors) which can be combined by addition or multiplication to obtain a result of the same type  
number five iron n : MASHIE  
number four iron n : MASHIR IRON  
numbering machine n : a device for the rapid stamping or printing of usu. consecutive numbers on the successive pages, sheets, cards, or discrete items  
num-ber-less \-ləs\ adj : too many to be counted : INNUMERABLE (the possible combinations are ~ —Alfred Marshall)  
number nine iron n : NIBLICK  
number one n : one's own interests or welfare : ONESELF (never neglects a chance to exploit a personal advantage on the theory ... that you've got to look out for number one)  
number one ad 1 : first in rank, importance, or influence : FOREMOST (America's number one woman golfer —Providence J.L. Evening News) 2 : (dated) one's hobby (the nation's number one hobby) —H.M.Ellis) (public enemy number one) 3 : of highest or of high quality : A1 2 (a real number one dinner)  
number one iron n : DRIVING IRON 2  
number plate n : a plate or label bearing an identifying number (pool car LICENSE PLATE number pool n NUMBER 11  
numbers pl of NUMBER, pres 3d sing of NUMBER  
number seven iron n : PITCHER 4  
numbers game also numbers pool or numbers racket n : NUMBER 11  
number sign n : a sign (# as in #2 pencil and apartment #32) used before a numeral to denote number  
number six iron n : MASHIE NIBLICK  
number theory n : the study of the properties of integers  
number three iron n : MID-MASHIE  
number two iron n : MIDIRON  
numbest superlative of NUMB  
numb \nʌmb\ n [*numb + fish*; fr. the numbing effect of its stock] : ELECTRIC RAY  
numbing adj [fr. pres. part. of *numb*] : causing numbness : DEADENING, STUPIFYING (a deep ~ hurt way down inside me —Billie Hamlet) (the significance of the title ... is explained at ~ length —Walcott Gibbs) numbing-ly adv  
num-ble also numb-les \ˈnʌmbəlz\ n pl [ME *numbles*, fr. OE *numblas*, pl. of *numbla* muscle from the thigh of a deer, fillet of beef, pork loin, modif. of L *lumbulus* small loin, fr. *lumbus* loin + *-ulus* -ule — more at LOIN] : certain edible viscera (as the heart, lights, liver) of an animal (as a deer) : UMBLES — compare GIBLET 1  
numb-ly adv : in a numb manner : INSENSIBLY, DULLY (his ... anguish hung about Peter Schmidt) (the men ... stared up at him —Irwin Shaw)  
numb n -es (\*numb + -ness*) 1 : reduced sensibility to touch (patients subsequently experienced a feeling of ~ in the thighs —Jour. Amer. Med. Assoc.) 2 : reduced sensitivity to perception or emotion : STUPOR (a drowsy ~ pains my sense, as though of hemlock I had drunk —John Keats) (dated from her waking ~ into complete oblivion —Mary Webb)  
numbrous adj [MF *nombreux*, fr. *nombre* number + *-eux* -ous — more at NUMBER] obs : NUMEROUS  
numbs pres 3d sing of NUMB  
numbskul var of NUMSKULL  
numskull \ˈnʌmskʊl\ n [*num-mad* or *na-mad* \ˈnɑːməd\ n-s (kindred *namda*, fr. Per *namad*, fr. MP *namat*; akin to Av *namata*-brushwood]; a thick felted rug of India and Persia usu. made of pounded goat's hair and embroidered with bird or floral designs in colored wool yarn —compare DRUGGET  
nu-men \ˈny(ŋ)mən\ n pl nu-mi-na -mə-nə\ n, no divine will,umen; akin to MHG *numke* to nod off, YG *nucke* to snore, *neim* to nod, GE *neuti* he moves, turn], *nytein* to prick, sting, Skt *navate, navati* he moves, turns] 1 a : a spirit believed by animists to inhabit a natural object or phenomenon (said to have set up one of the stones ... and to have poured oil on the top of it as an offering to the indwelling —E.O.James) b : a presiding spirit : a local deity (the exercised watch and ward over the little household —J.B.Ness) 2 : a minor, creative force : GENIUS (the strange and powerful ~ which, he felt, used him as its tabernacle —Aldous Huxley)  
nu-me-ni-us \ny(ŋ)mēnēəs\ n, cap [NL, fr. LGk *neomēniōs*, a bird, perh. the curlew, fr. GK *neomēnia*, *neomēnia* new moon, first of the month, fr. *ne-* + *mēnēthia* + *-ia* —more at MEN] : a genus of birds (family Scolopaciidae) consisting of the cuckoos  
nu-mer-a-ble \ˈny(ŋ)m(ə)rəbl\ adj [L *numerabilis*, fr. *numerare* to count + *-abilis* -able —more at NUMBER] : capable of being counted (the small ~ band of runaway planets —A.N.Whitehead)  
nu-mer-al \ˈny(ŋ)m(ə)rəl\ adj [MF, fr. LL *numeralis*, fr. L *numerus* number + *-alis* -al —more at NUMERAL] 1 : of, relating to, or expressing numbers (an ~ adjective) (used the letters of their alphabet for ~ symbols —D.E.Smith) 2 : consisting of numbers or numerals (~ cipher) —nu-mer-al-ly \-rələ-, -li\ adv  
numeral \ˈnʌm(ə)rəl\ n-s 1 : NUMBER 6 2 numerals pl : the numbers designating by year a school or college class (carried a banner with the class ~s on it in the reunion parade) (won ~s in basketball, baseball, and track) —compare LETTER 6 SYN see NUMBER  
nu-mer-ate \ˈny(ŋ)mərə,tāt\ vt -ED/-ING-/S [L *numeratus*, past part. of *numerare* to count] : to give a detailed list of : ENUMERATE (might have been illuminating had he enumerated the mistakes made by each side —Mary K. Hammond)  
nu-mer-a-tion \ˈny(ŋ)mərəˈtʃən\ n-s : a numerical enumeration, fr. L *numerare* to count + *-tion* -tio -ion] 1 a : a system or process of enumeration (the positional system which came at length by way of the Arabs to supersede the clumsy ~ of the Romans —Times Lit. Supp.) b : the application of enumerative processes : COMPUTATION (study of African or American Indian languages shows systems of ~, often on a decimal scale —D.J. Griffiths) c : the act of counting or applying numbers to something : CENSUS, NUMBERING (make an exact ~ of the population)



numbering  
machine

**nu-mer-a-tive** \n(ə)ʹumərəd-əd-,mə,rād-ə\ adj [numerate + -ive] archaic : of or relating to number or numeration (a noun interposed between it and the substantive —R.K.Douglas)

**²numerative** \n(ə)s- CLASSIFIER n  
nu-mér-a-to(r) \n(ə)ʹlɪmɑːrəd-(r)-, -tə- t̃o-n s-[F numérateur, fr. LL *numerator*, from Latin *cobere* fr. L *numerus* (past part. of *numero*) to count] or 1 : the part of a fraction that is above the line and signifies the number of parts of the denominator taken : DIVIDEND 2 [LL]: one that numbers  
**nu-mer-ic** \k(ə)n(ə)ʹyū,mərĭk\ adj [L *numerus* number + E -ic]  
NUMERICAL 1; esp.: denoting a number or a system of numbers (~ code) (& sign)  
**nu-mer-i-cal** \-rĭskəl,-rĭskəl-\ adj [L *numerus* number + E -ical] 1 : relating to numbers ~ analyst (~ superiority of the enemy) b 2 : denoting a number (letters of the alphabet were employed as ~ signs—William Chomsky c: expressed in figures rather than letters (spies . . . used a very simple cipher, which changed every day—Alexander D'Agapeeff) (the ~ proportions of hybrid crosses—Lancelot Hogben) (= equation) d: designated by number continuous (of numerical value) e: of or relating to ability to think or work with numbers (~ skill) (~ the factor of a test)—compare VERBAL 2 a **archaic**: of a corresponding type ; INDISTINGUISHABLE, SAME (many of these ~ postures . . . are found in statues of the ancients—John Bulwer) b **obsolete**: IDENTICAL (in a river we swim in the same place, though not in the same water—Thomas Fuller) c: probably that very thing kept in the temple—Thomas Fuller

**numerical aperture** *n*: a quantity that indicates the resolving power of a microscope objective and that is numerically equal to the product of the index of refraction of the medium in front of the objective and the sine of the angle which the most oblique ray entering it makes with the optical axis

**nu-mer-i-cal-ly** \-kəl(jē)\ adv [*numeric*] adverbial 1 a : in respect to numbers (~ inferior but intellectually potent group—K.S.Davis) b : according to number (copy . . . is filed ~ —E.M.Robinson) c : in figures (if a date is written ~ —Marjorie E. Skillin & R.M.Gay) 2 : in a precisely similar way ; INDISTINGUISHABLY (the emotion . . . is not ~ identical—John Dewey)

**numerical rating system** *n*: a system of establishing insurance premium rates for standard lives on the basis of numerical weights for various impairments

**numerical value** *n* 1 a : a quantitative value assigned to a letter of the alphabet (exegetical rule . . . according to which every Hebrew letter has a *numerical value*—S.A.Binion) b : a sum obtained by adding together the numerical values of the letters in a word or phrase (if two names had the same *numerical value*, this fact showed some relation between the individuals—D.E.Smith) — compare GEMATRIA 2 : ABSOLUTE VALUE

**nu-mer-ist** \n(ə)ʹumərĭst\ n-s [L *numerus* number + E -ist] **archaic**; NUMEROLOGIST

**nu-mer-o-log-i-cal** \n(ə)ʹumə-ro-'lŏj-kəl\ adj : of or relating to numerology

**nu-mer-ol-o-gist** \n(ə)ʹumə-'räl-jə-st\ n-s : a specialist in numerology (bets \$2000 on a horse, after consulting his private ~ —Malcolm Cowley)

**nu-mer-ol-o-gy** \-jē, -ji\ n-es [L *numerus* number + E -o- + -logy]: the study of the occult significance of numbers — compare MATHEMATICS

**nu-mer-os-i-ty** \n(ə)ʹumə-'rās-dē-\ n-es [MF *numerosité* numerousness, fr. LL *numerositas*-*numerositas*, fr. L *numerosus* numerous + -itat-, -itatis -ity] 1 : NUMEROUSNESS (the earliest scales of measurement were scales of ~ —scales for the counting of pebbles or cattle or warriors—S.S.Stevens) 2 a : many times under natural conditions (The gods have occurred ~ (depends regarding buried treasure. . . are as ~ as they are improbable—Thomas Barbour) b : consisting of a great number of individuals : LARGE, MULTITUDINOUS (It was too bad that the family was ~: each man got only one share . . . instead of two—Ernest Beaglehole) (this species has become infinitely more ~ during the past century) c : pertaining to a great number of individuals (the birds begun at four o'clock . . . music ~ —Emily Dickinson) 2 **archaic**: musically cadenced : RHYTHMICAL (blank verse . . . falling occasionally almost into ~ prose—Henry Hallam)

**nu-mer-ous-ly** adv : in large numbers : ABUNDANTLY (letters have been arriving ~ since last month—Thompson)

**nu-me-r-us** \-əs\ -es: the quality or state of being numerous (*nu-me-r-us-claus-u's* /nũ'mə-'ro:s,klaus-ű's/ *n* [NL, lit., closed or restricted number] : a quantity fixed as the maximal number or percentage (as of applicants of a particular race or class) admissible to an academic institution)

**nu-mid-a** \n(ə)ʹumədə-\ *n*, cap [NL, fr. L *Nimidia* Numidian, fr. Punic *Numida* related to the pheasants and peacocks and domesticated guinea fowls and closely related African wild guinea fowls]

**¹nu-mid-i-an** \(')(n)ʹyū,mīdē-\ adj, usu cap [L *Numidianus*, fr. *Numidia* + -ianus -ian]: of or relating to Numidia, an ancient country of No. Africa nearly coextensive with modern Algeria

**¹num-id-i-an** \\\-n-s cap 1 : a native or inhabitant of ancient Numidia 2 : the Berber language of the Numidian people

**numidian alphabet** *n*, usu cap N : LYBIAN ALPHABET

**numidian crane** *n*, usu cap N : DEMOISELLE 2a

**nu-mid-i-dae** \n(ə)ʹyū'mido,dē-\ *n pl*, cap [NL, fr. *Numida*, type genus + -idae]: a family of African and Asian ground dwelling birds allied with them in the family Phasianidae and that comprise the guinea fowls — see NUMIDA

**numina** *pl* of MUMEN

**¹nu-mi-nous** \n(ə)ʹymənəs\ adj [L *numin-*, *numen* numen + E -ous —more as MUMEN] 1 a : of, relating to, or characteristic of a numen : SUPERNATURAL (a single deity presiding over the world—the world dedicated to or hallowed by association with a deity : SACRED (& wood) c : having talismanic properties : MAGICAL (all quests are concerned with some ~ object, the waters of life, the Grail, buried treasure—W.H.Auden) 2 a : filled with a sense of the presence of divinity : HOLY (the holiest, most ~ moment in the Mass—the moment of transubstantiation—C.A.Latour) b : inspiring reverence (an awe-inspiring cathedral—C.E.Raven) 3 : appealing to the higher emotions or to the aesthetic senses : SPIRITUAL (when tradition has lost its . . . ~ authority—George Santayana) (the candle was a graceful . . . and ~ method of illumination—New Yorker) b : beyond understanding or description : MYSTERIOUS, INCOMPREHENSIBLE (emphasizes the ~ aspect of writing—Time magazine)

**²numinous** \-mə'nē-shəs\ adj [*numinos* fr. L *numen* numen + E -ous-unseen but majestic presence that inspires both dread and fascination and constitutes the nonrational element characteristic of vital religion : a psychic revelation of deity producing religious awe and ecstasy —usu. used with the (African Bushmen, awed by the presence of the ~ at a given place—Joachim Wachter) (the ~ of the sun) (and seers regarding their experience of the ~—William Telfer)]

**nu-mis-mat-ic** \n(ə)ʹumaz,'mek-adj [-mos-, -at], jek\ also **nu-mis-mat-i-cal** \-kal,\ jek\ adj [numismatic fr. F *numismatique*, fr. L *numisma*-, *numisma*, *numismata*-, *numisma* money, coin (fr. GK *nomisma*-, *nomisma* custom, usage, currency, coin) + F -ique, *numismatic* fr. Gk.] b : growing powerfully ~ (-ally) (+ -al) in common usage, law — more a ~ NUMISMATIC (or of or relating to numismatics {will accept any dime but would prefer it to be of some ~ value—J.M.Hage-man} 2 : of or relating to currency : MONETARY (cowrie shells

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